Studies of Socotran birds III. Morphological and mensural evidence for a 'new' species in the Rufous Sparrow *Passer motitensis* complex endemic to the island of Abd 'Al-Kuri, with the validation of *Passer insularis* Sclater & Hartlaub, 1881

by Guy M. Kirwan

Received 15 February 2007

The present study represents the third in a series of papers that seeks to re-examine the taxonomic status of avian forms described from the Socotran archipelago. It follows publications concerning the population of Nubian Nightjar *Caprimulgus nubicus*, which was previously regarded as an endemic subspecies, *jonesi* (Kirwan 2004), and a re-evaluation of species limits in Golden-winged Grosbeak *Rhynchostruthus socotranus* (Kirwan & Grieve 2007). These notes seek to stimulate renewed interest in taxonomic studies of Socotran birds, specifically to meet the challenge set by Martins (1996), who stated: 'There is a clear need for a review of the avifauna of Socotra which reflects contemporary systematic thinking.'

All originally described as species, the six allopatric groups (and nine constituent taxa) within the almost exclusively Afrotropical Rufous Sparrow *Passer motitensis* complex have suffered a rather checkered taxonomic history of late. Following their demotion to subspecies, this arrangement persisted through Moreau & Greenway (1962), White (1963) and Hall & Moreau (1970). Thus, despite the contrary opinions of van Someren (1922), Lynes (1926), Grant & Mackworth-Praed (1944), Bannerman (1948) and Macdonald (1957) concerning some or all of these taxa, it was not until Wolters (1982), who split *P. insularis*, from the island of Socotra, off north-east Africa, and Summers-Smith (1984, 1988), who separated *P. iagoensis*, from the Cape Verde archipelago, at the level of species that more than one species tended to be recognised by major works. This notwithstanding the riposte of Bourne (1986) to Summers-Smith (1984) wherein Bourne could find little to recommend the advancement of *iagoensis* to specific status beyond the need for 'a tiresome change of name'.

Thus, Sibley & Monroe (1990) recognised the following specifically: *P. iagoensis*, *P. insularis*, *P. rufocinctus* (including *cordofanicus* and *shelleyi*), from East Africa, and *P. motitensis*, from South Africa north to southern Angola (which arrangement was followed by Gill & Wright 2006). In contrast, Dowsett & Dowsett-Lemaire (1993), followed by Dickinson (2003) in his important world checklist, preferred to recognise just *motitensis* and *iagoensis* as species, and pointed to errors and inconsistencies in the work of Wolters and Sibley & Monroe. However, the relevant volume of the influential *The birds of Africa* elected to recognise *P. shelleyi* (spottily in Ethiopia and Somalia south to Kenya) and *P. cordofanicus* (from west-central Sudan to eastern Chad), in addition to the four taxa separated by Sibley & Monroe, specifically (Urban *in* Fry & Keith 2004), albeit not without criticism (Leonard & Demey 2006). Thus, in recent years, only *motitensis* and *iagoensis* have received reasonably widespread recognition as being meritorious of specific status (Cramp & Perrins 1994 and Hazevoet 1995 also afforded *iagoensis* such treatment).

Passer [*motitensis*] *insularis* Sclater & Hartlaub, 1881, was unsurprisingly (given its abundance, which is currently placed at *c.*230,000 individuals: R. F. Porter *in litt.* 2007) amongst the initial wave of taxa endemic to the ancient island of Socotra to be described, following

the first scientific visit to the archipelago, by Sir Isaac Bayley Balfour, who spent almost seven weeks there in 1880. It was not until the considerably more extensive survey by Ogilvie-Grant & Forbes, in 1898–99, that *Passer* [*motitensis*] *hemileucus* Ogilvie-Grant & Forbes, 1899 (hereafter referred to as *P. hemileucus*), was discovered. The latter is endemic to Abd 'Al Kuri, a rather inhospitable island with no permanent running water, *c.*36.5 km east to west and a maximum of *c.*5 km north to south, which lies *c.*145 km west of the main island and rises to a maximum 743 m (Cheung & DeVantier 2006). Abd 'Al Kuri covers 133 km^2, whereas Socotra is 3,625 km^2 in area. Our knowledge of *insularis* has increased substantially (see, e.g., Kirwan *et al.* 1996) since even the work of Summers-Smith (1988), who was able to make scarcely even the most basic comments about the bird's natural history, but *hemileucus* has remained a mysterious taxon known almost solely from specimens, namely the type series and seven birds collected by Alec Forbes-Watson in spring 1964. In reporting on the latter collection, Ripley & Bond (1966), in an immense understatement, referred only to *hemileucus* being paler than *insularis*. In consequence the taxon's obvious distinctiveness has gone unappreciated, though its describers (Ogilvie-Grant & Forbes 1899) were clearly aware of this as their manuscript makes plain (even allowing for the fact that all such novelties were then afforded species status). Summers-Smith (1988) opined that 'although paler and slightly smaller the differences are not great enough to warrant their separation from the birds on Socotra even as a different race.' Clement *et al.* (1993), presumably impressed by Summers-Smith's statement as to the weak distinction, simply ignored *hemileucus*. Urban (2004), in contrast, noted it as being 'Much paler than *insularis*, underparts nearly pure white, black patch on chin of ♂ smaller, ♀ without dusky patch on throat', and also remarked on the overall smaller size of *hemileucus* (something which had not escaped, but apparently failed to impress, Summers-Smith). None of these commentators, with the exception of Dillon Ripley and Bond, appears to have examined the Forbes-Watson specimens, and it might be wondered whether the first two authors looked carefully at the, admittedly limited, material to hand in The Natural History Museum (Tring). In fact, *Passer hemileucus* appears as easily diagnosable as any other member of the Rufous Sparrow complex admitted to species status by Urban (2004).

Methods

I acquired mensural data from specimens of both Socotran taxa held at The Natural History Museum (NHM, Tring), as follows: *Passer insularis* (Socotra: *n*=15, including nine males, one of them juvenile which was not included in the mensural analysis), and *Passer hemileucus* (Abd 'Al Kuri: *n*=2, including one male), and the National Museum of Natural History (Smithsonian Institution), Washington DC: *P. insularis* (Socotra: *n*=20, including ten males), and *P. hemileucus* (Abd 'Al Kuri: *n*=7, including four males). I did not examine the single male specimen of *hemileucus* or the seven (both sexes) of *insularis* held in the National Museums and Galleries on Merseyside, Liverpool (C. W. Fisher & T. Parker *in litt.* 2007) or the two specimens of *insularis* held at the University Museum of Zoology, Cambridge, UK. Note that Forbes-Watson's expedition report (which was never published) records that he took 28 males and 23 females of *insularis*, but the whereabouts of the additional specimens are unknown; notes in the Smithsonian collection report that specimens of some other species were sent as exchanges with museums in Africa, e.g. the Natural History Museum in Bulawayo (M. P. S. Irwin *in litt.* 2007). Mass data for these additional specimens are presented in the unpublished report and are repeated in Table 1. The types of both were examined: *P. insularis* (NHM 1881.3.21.20) and *P. hemileucus* (NHM 1899.8.11.131). The following data were obtained from each specimen: wing-chord (flattened) and tail-length,

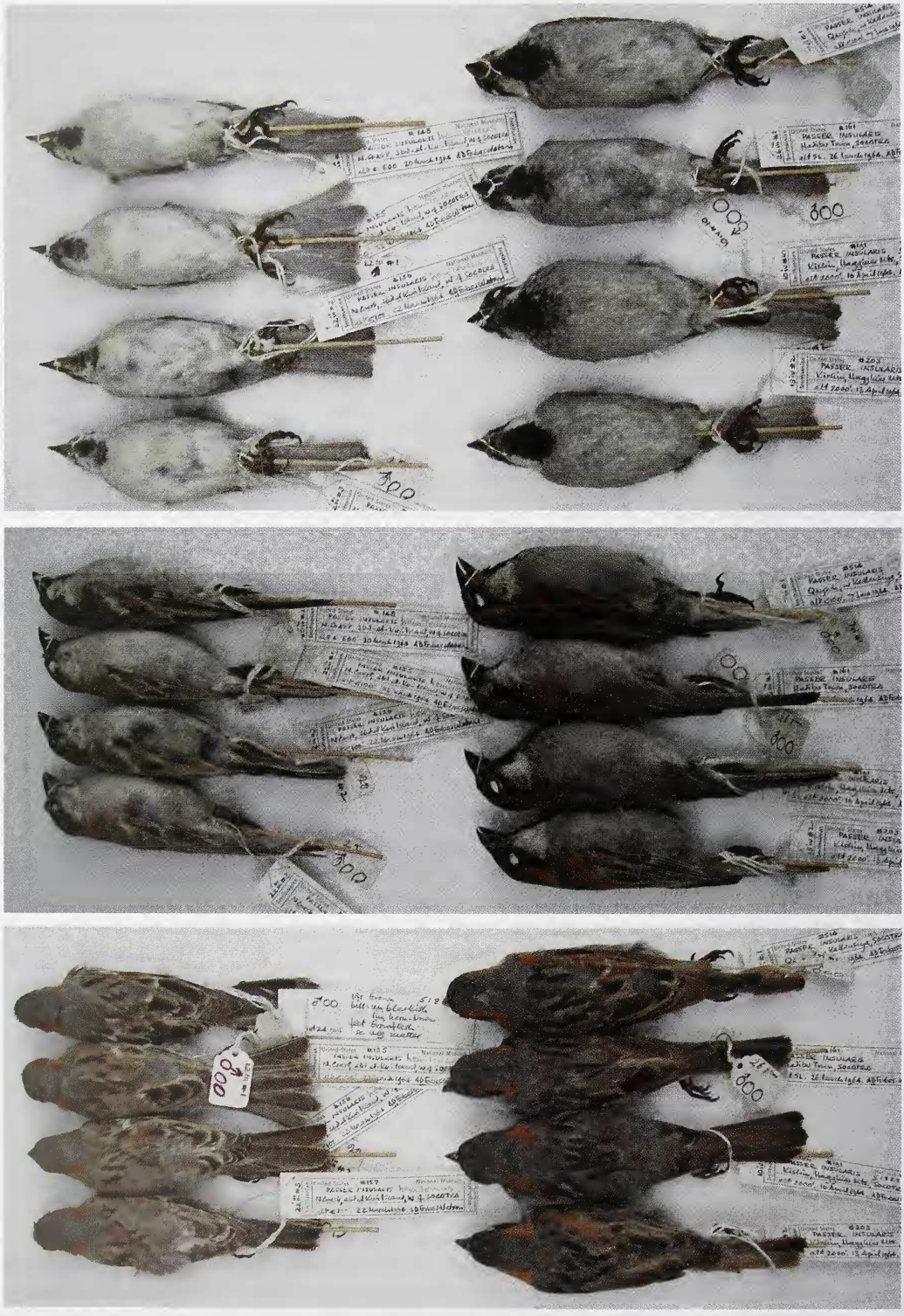
using a standard metal wing-rule with a perpendicular stop at zero (accurate to 0.5 mm), and culmen-length (to skull) and culmen-depth (at the feathers), using digital callipers (accurate to 0.01 mm). I also conducted a morphological examination of 33 specimens of *P. cordofanicus* and 29 of *P. shelleyi* held in NHM (including the holotype, NHM 1887.9.28.314, of *shelleyi*), these being the geographically most proximate forms within the complex in continental Africa, especially *P. shelleyi* which at least formerly maintained a toehold in north-westernmost Somalia (Ash & Miskell 1998).

Notes on plumage variation in both sexes of the two forms were taken and ranked according to their usefulness in distinguishing them. I attempted to conservatively score character differences for males using the system elucidated by Collar (2006), which will be fully tabled by Collar *et al.* (in prep.). Numbers in brackets refer to this scoring system, ranging from 3 for a dramatic difference to 1 for a more minor difference. A broad range of material, pertaining to both forms, was photographed, using a Nikon Coolpix 885 digital camera (see Figs. 1–6).

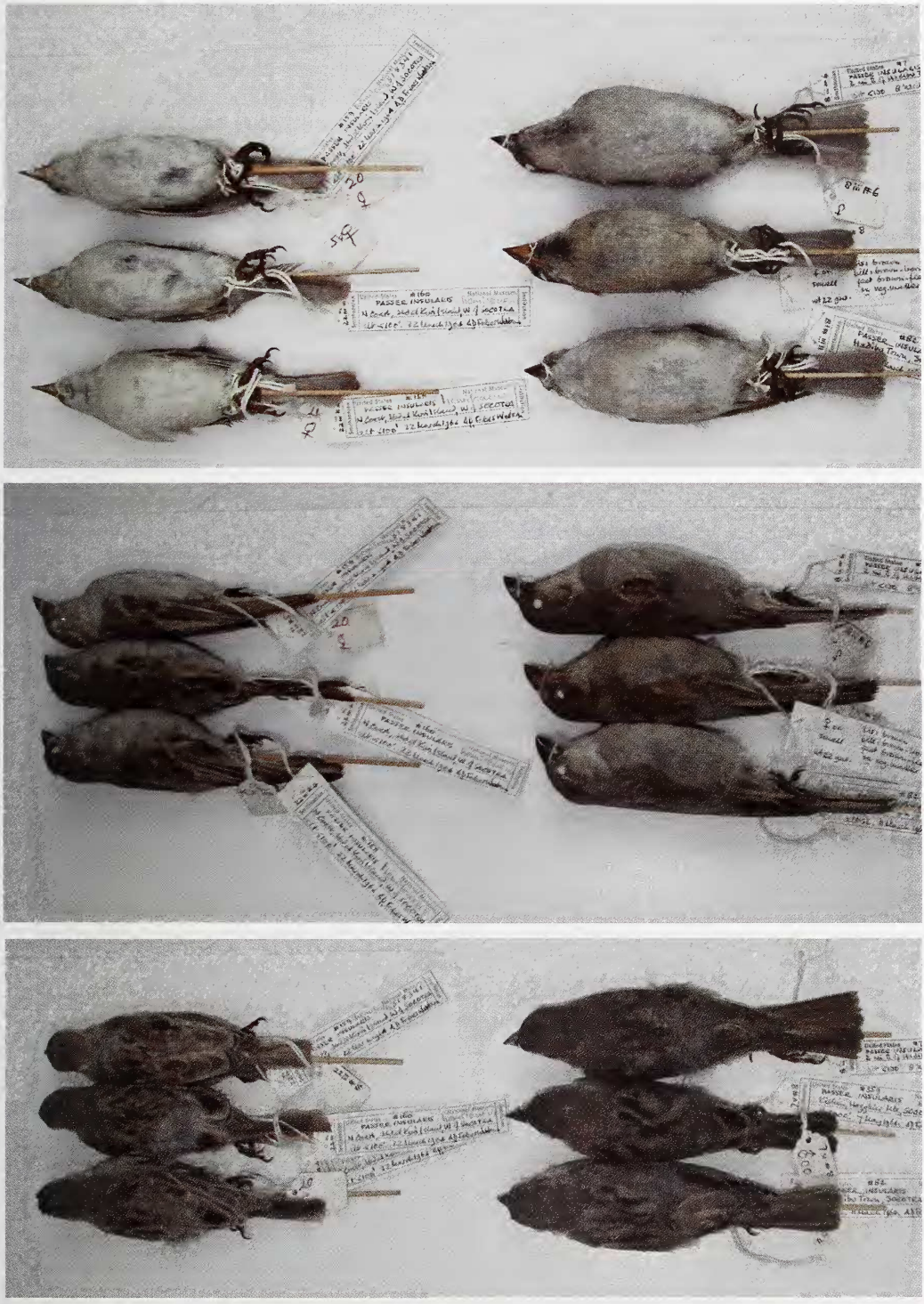
Results

Plumage analysis.—Comparison of plumage characters in *Passer insularis* and *P. hemileucus* revealed striking differences, coincident with the recognition of two species. In males, compared to *insularis*, *hemileucus* has much paler underparts lacking any of the dirty grey tones with which the entire underparts of *insularis* are washed and which contrast much more noticeably with the white cheeks in the latter form; the dark throat patch is confined to the bib in *hemileucus* but is far more expansive and more solidly black in *insularis* (Fig. 1), though R. F. Porter (*in litt.* 2007) cautions that it may appear smaller and less striking in February/March; the median coverts show prominent white tips in *hemileucus*, but much smaller, less obvious and grey-coloured ones in *insularis*, whilst the chestnut tones in the wing of *hemileucus* are much purer and less saturated than on *insularis*, recalling the difference between Eurasian Tree *P. montanus* and Spanish Sparrows *P. hispaniolensis*; the black ear-coverts are more restricted in *hemileucus*, and *insularis* also has more extensive and deeper black lores (Fig. 2); the crown-feathers have much paler centres in *hemileucus*; and finally the mantle and back are much browner and less heavily and darkly streaked in *hemileucus*, lacking many of the grey background hues of *insularis* overlain with broader and blacker streaks (Fig. 3). I scored two points each for the differences in head pattern, upperparts pattern and underparts coloration, with additional single points for the difference in wing pattern and size (see below), thus giving a total of eight points. The minor range of variation in these features in four males of each taxon is depicted in Figs. 1–3.

Females of the two taxa are almost equally distinctive. As evidenced by Figs. 4–6, female *hemileucus* has overall much whiter underparts than *insularis*, though like males *hemileucus* females exhibit some buffy tones especially on the breast and flanks, whilst *insularis* has overall much greyer underparts, though some variation is evident. No specimens of *hemileucus* show any evidence of a dark bib, a feature evident in all *insularis*, though one (NMNH 518324) almost lacks any trace, dark feathering being confined to the bases of the central throat (Fig. 4). *P. hemileucus* has a more obvious pale supercilium behind the eye and lacks any trace of dark feathering on the ear-coverts (female *insularis* are more male-like); like males, female *hemileucus* shows reasonably prominent pale tips to the median coverts, which are not apparent in *insularis*; and, again as in males, *hemileucus* has generally much browner upperparts with slightly browner and less broad streaking on the mantle and back, compared to the generally much greyer and darker upperparts of *insularis*, marked with generally broader and blacker streaking. Females of these two taxa would seem to be far



Figures 1–3. Ventral, lateral and dorsal views of males of *Passer hemileucus* (left) and *P. insularis*, collected in the Socotran archipelago, in spring 1964, by A. D. Forbes-Watson (Guy M. Kirwan / Smithsonian Institution, Washington)



Figures 4–6. Ventral, lateral and dorsal views of females of *Passer hemileucus* (left) and *P. insularis*, collected in the Socotran archipelago, in spring 1964, by A. D. Forbes-Watson (Guy M. Kirwan / Smithsonian Institution, Washington)

more readily identifiable in a field context than, for example, those of House *P. domesticus* and Spanish Sparrows.

Male *hemileucus* differs from *shelleyi* in having greyer upperparts with much paler and narrower dark streaking, paler brown tertial centres and rectrices, a greyer crown, lack of any rufous in the rump, less bold and solid black ear-coverts and bib, and the rufous superciliary does not wrap around the rear edge of the ear-coverts. Female *hemileucus* also lacks the rufous rump of female *shelleyi*, any rufous in the mantle, has much fainter upperparts streaking, a much paler crown, tertials and flight-feathers, and lacks any trace of a bib (quite noticeable in *shelleyi*).

Compared to male *hemileucus*, the same sex of *cordofanicus* has a rufous rump, the mantle and back are overlain with sparse but very deep black streaking (dark brown streaking in *hemileucus*), the flight-feathers are darker, the white tips to the wing-coverts are seemingly narrower, the rufous superciliary continues to wrap around the ear-coverts, and the bib and upper border to the ear-coverts are both deep black. Unlike *hemileucus*, female *cordofanicus* is rather similar to the male of that taxon, except that it has a much paler (greyer) but still rather extensive bib; furthermore the crown is much darker grey than in female *hemileucus*.

Finally, compared to these two mainland African forms, *insularis* is clearly differentiated by a broad range of characters, e.g. rump coloration, underparts coloration etc. The closest of the *motitensis* group in plumage is *rufocinctus* (Kenya and northern Tanzania; 53 specimens examined in NHM). Male *insularis* differs from *rufocinctus* in the following: lack of rufous rump; darker grey upperparts with narrower, slightly less black streaking (especially noticeable on the crown / nape); more diffuse, slightly larger and less deep black bib; on average greyer underparts; ear-coverts largely white (grey in *rufocinctus*) with black eye-stripe (absent in *rufocinctus*); greater coverts with much more rufous (generally none in *rufocinctus*); a larger bill; whilst the irides are pale in *rufocinctus* but dark in *insularis*. Female *rufocinctus* has a rufous rump and lesser coverts, heavier black upperparts streaking, a more noticeable and more extensive grey ('shadow') bib, greyer ear-coverts (white in *insularis*), generally more grey-saturated crown and nape (dark feather bases more noticeable in *insularis*), and a shorter bill.

Morphometrics.—Mensural data appertaining to the two Socotran taxa are presented in Table 1. These reveal the rather obvious differences in their relative sizes. Compared to *insularis*, *hemileucus* is shorter winged, shorter tailed, smaller billed (particularly obviously in bill-depth, much less so in culmen-length), and lighter in weight. These differences are readily apparent in both sexes and, particularly in wing- and tail-length, there being no or very little overlap between the two taxa.

Discussion

Vocal data are non-existent for *P. hemileucus* and rather weak (few sound-recordings) for *P. insularis*. In any case differentiation in *Passer* is generally rather weakly expressed in terms of vocalisations, songs being rather unspecialised although they do possess an advertising function (Cramp & Perrins 1994). The available data concerning plumage and morphometrics unambiguously supports recognition of two species under any species concept currently operating, including all of the pattern-defined concepts (Sluys & Hazevoet 1999), the Metapopulation Lineage Concept or General Species Concept (de Queiroz 2005) or any of the more modern interpretations of the Biological Species Concept (e.g. Helbig *et al*. 2002, Collar 2006, Collar *et al*. in prep.). The differences between either sex of *insularis* and

hemileucus are clearly as great as between any of the other members of the Rufous Sparrow *P. motitensis* complex currently recognised at species level, as well as between any of the five members of the (also Afrotropical) Grey-headed Sparrow superspecies *P. griseus* sometimes accorded specific recognition (see Urban 2004). Indeed, it is interesting to note the quite close morphological resemblance between both sexes (but especially males) of *hemileucus* and those of Sind Jungle Sparrow *P. pyrrhonotus* of south-east Iran to north-west India, which fact was noted by the authors of the new taxon but which has apparently escaped more recent commentators (Fig. 7). The substantial difference in size between *hemileucus* and *insularis* would presumably act as a significant barrier to the chances of their interbreeding should they come into contact.

Almost nothing has been published concerning the habits and behaviour of *P. hemileucus*, although it has been found in most parts of the island of Abd 'Al Kuri (R. F. Porter *in litt.* 2007), the only data being those recorded by Ogilvie-Grant & Forbes (1903), who found it to be unassociated with Man, in obvious contrast to *insularis*. They stated:

'It was never seen in the neighbourhood of the native village, but appeared to be confined to the bush-clad slopes of one of the highest points, where enormous limestone blocks which have fallen away from the summit lie scattered over the hillside. Here it makes its home, and we found it by no means an easy task to secure specimens for they are very shy and not very numerous [*contra* the statement in Kirwan *et al.* 1996] . . . A small flock, however, kept flitting about near me on the stems of the bizarre Milk-bushes (*Euphorbia Abdelkuri*) growing about in the middle of the mountain, while I was engaged in digging up the fine specimen of this new plant, which eventually reached home alive—*H.O.F.*'

In 1964, Alec Forbes-Watson's experience (as recorded in his unpublished expedition report) was slightly different. He managed to collect seven of the dozen birds seen, but intially found them very wild and unapproachable in the hills. However, two days later (on 22 March), AF-W found *hemileucus* at a settlement on the north coast 'behaving like *P. domesticus* or their relatives on Socotra'. Despite their shyness and AF-W's persistence in collecting them, the birds consistently returned to a single *Salvadoria* bush, which was 'the only greenery in sight'. A juvenile has been trapped in late March (Fig. 8; R. F. Porter *in litt.* 2006). Future ornithological studies on Abd 'Al-Kuri will prioritise documenting this sparrow's population, range and habitat preferences, and any apparent threats (R. F. Porter *in litt.* 2007). *P. hemileucus* has been confirmed to breed in four of the island's six UTM grid squares and presence established in one other (R. F. Porter *in litt.* 2007), suggesting that its population is perhaps secure at present, but its conservation status, if species status were to be generally admitted, clearly requires evaluation, as *hemileucus* is confined to a small island and probably has an overall small population.

Fresh material pertaining to *hemileucus* and *insularis* will be of value to molecular studies that should seek to date the divergence between the two forms, although the Forbes-Watson material is sufficiently recent to permit such an undertaking with relative ease (Payne & Sorensen 2003). Socotra originally formed part of the African–Arabian tectonic plate (it represents a continuation of the Somali peninsula) and probably became isolated by the same series of dislocations during the break-up of Gondwana that produced the Gulf of Aden in the late Tertiary, at least 10MYA (Laughton *et al.* 1970). The Socotra Platform on which all of the islands lie, a small continental granite block over which the seas are relatively shallow, has experienced relative tectonic stability since *c.*6–8MYA and particularly since the onset of the Pliocene (Fournier *et al.* 2001). Periods of uplift in the general region of the southern Gulf of Aden terminated *c.*2MYA. During the Last Glacial Maximum (20,000–25,000 years ago), when sea levels were up to 120 m lower than in the present day, the coastal plain of the main island of Socotra was much larger than now and encompassed

TABLE 1

Mensural and weight data for *Passer insularis* and *P. hemileucus*. All measurements in mm; weight in g. Personal measurements (from specimens in The Natural History Museum, Tring, and National Museum of Natural History, Washington DC) were taken using a standard metal wing-rule with a perpendicular stop at zero (accurate to 0.5 mm), and digital callipers (accurate to 0.01 mm). Dymond (1993) did not take comparable measurements for culmen-length and did not measure bill-depth.

Taxon	Sex	Sample size	Wing-length	Tail-length	Culmen (to skull)	Bill-depth	Mass (reference)
P. insularis							
	male	18	72.5–78.5	58–65	15.12–17.04 (n=16)	8.58–10.13	20–33 (Forbes-Watson unpubl.)
means			76.19	60.55	16.16	9.37	26.32 (n=28)
	female	16	71.0–76.5	52–63	15.41–17.51	8.80–10.06	22–35 (Forbes-Watson unpubl.)
means			73.75	58.12	16.49	9.44	27.52 (n=23)
Published data from Dymond (1996), range plus means	male	5	74–79	53.5–61.0			25.0–29.2
			74	58.6			27.5
	female	4	72–76	58.0–60.5			26.0–29.1
			74.7	59.2			27.1
P. hemileucus							
	male	5	70.5–73.0	53–57	15.05–16.74	7.90–8.83	20–25 (Forbes-Watson unpubl.)
means			72.3	55	15.75	8.3	23.0 (n=4)
	female	4	67.0–69.5	50–54	14.66–15.57	7.39–8.94	20–24 (Forbes-Watson unpubl.)
means			68.6	52.5	15.18	8.22	21.33 (n=3)

the islands of Darsa and Samha (The Brothers) which lie almost equally equidistant between the main island and Abd 'Al Kuri. Indeed, because of the generally shallow seas between Socotra and The Brothers (30–50 m), land bridges between these islands existed on several occasions during the Upper Pleistocene, occurring in 100,000-year cycles (Cheung & DeVantier 2006). It is unsurprising in the present context therefore that Samha and Darsa should host typical *P. insularis* (R. F. Porter *in litt.* 2006), though P. G. Ryan (*in litt.* 2007) has remarked that populations on these two islands are small, rather like *hemileucus*, and lack the grey extending onto the breast. Populations on all four islands thus require some further research into their taxonomy and relationships. Abd 'Al Kuri, unlike the other satellite islands of Socotra, has been long separated from the main island with resultant levels of endemism, e.g. amongst reptiles (Rösler & Wranik 2004), plants (Miller & Morris 2004), molluscs (Neubert 2002) and marine fishes (Klaus & Turner 2004), whilst one other endemic bird taxon, *Onychognathus blythii creaghi*, has been described from Abd 'Al Kuri, though its validity requires further investigation (Kirwan 2007).

The degree of differentiation between the *Passer* taxa in the Socotra archipelago might suggest separate colonisation events, perhaps even involving different metapopulations from Africa and Asia. The phylogeographic study of western Indian Ocean sunbirds conducted by Warren *et al.* (2003) offers an interesting case study with some parallels to the Socotran situation. Most of the latter islands' breeding birds are clearly of Afrotropical origin, as long ago noted by Chapin (1932), but there has been, as yet, no attempt to date the different colonisation events that presumably occurred, nor efforts to test whether some of the endemic taxa might be of Asian ancestry, for example the grosbeak *Rhynchostruthus socotranus* (see Kirwan & Grieve 2007).

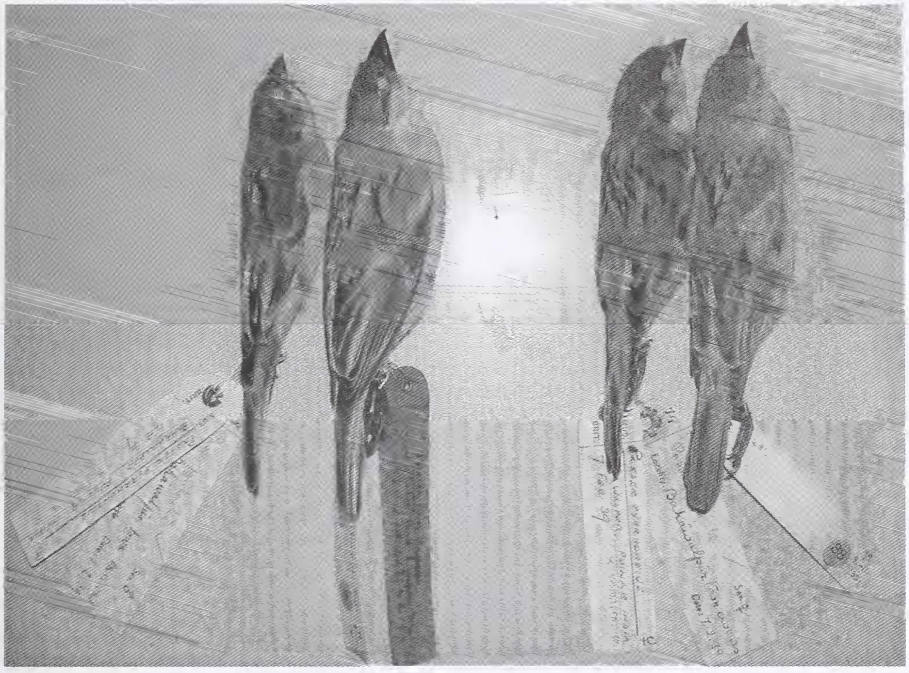


Figure 7. Comparison between both sexes of *Passer hemileucus* and *P. pyrrhonotus*, from left to right: male *P. pyrrhonotus*, male *P. hemileucus*, female *P. pyrrhonotus* and female *P. hemileucus* (Guy M. Kirwan, © Natural History Museum, Tring)

Figure 8. Juvenile *Passer hemileucus*, Abd 'Al Kuri, Socotra, late March (Ahmed Saeed Suleiman & Nadim Taleb / Socotra Conservation & Development Programme)

This study reconfirms the importance of the Forbes-Watson collection from the Socotran archipelago and the unpublished expedition report (see Kirwan 1997), not only for taxonomic studies of the islands' birds but also many aspects of their natural history. The 523 specimens that originally constituted the collection are a remarkable testament to Forbes-Watson and his two Kenyan taxidermists, and continue to represent the best (and most beautifully prepared) series of birds from Socotra; the previous lack of attention that has been paid to this resource borders on the extraordinary.

Acknowledgements

I am grateful to staff members at the Natural History Museum, Tring (Robert Prŷs-Jones, Katrina Cook, Alison Harding and Mark Adams) and National Museum of Natural History, Washington DC (James P. Dean, Carla J. Dove, Christina A. Gebhard, Gary Graves and Brian K. Schmitt), for their assistance at these institutions. Richard Porter sent field photographs of Socotra sparrows for my use and Clemency Fisher and Tony Parker assisted with a copy of the Liverpool Museum database relating to their Socotra holdings and some reference material. With the permission of the authors, Stuart Butchart (BirdLife International) forwarded a copy of the Collar *et al.* paper in preparation. Michael Jennings' persistence was essential in tracking down the unpublished expedition report of Alec Forbes-Watson, and I am grateful to Jennings, Porter and Peter Ryan for their constructive commentaries on this manuscript. Field work in Socotra was undertaken within the framework of the 1993 Ornithological Society of the Middle East (OSME) South Yemen expedition. OSME also provided financial support that permitted my museum studies in North America.

References:

Ash, J. & Miskell, J. 1998. *Birds of Somalia*. Pica Press, Robertsbridge.

Bannerman, D. A. 1948. *Birds of tropical West Africa*. Crown Agents, London.

Bourne, W. R. P. 1986. Recent work on the origin and suppression of bird species in the Cape Verde islands, especially the shearwaters, the kites and the sparrows. *Bull. Brit. Orn. Cl.* 106: 163–170.

Chapin, J. P. 1932. The birds of the Belgian Congo, Part I. *Bull. Amer. Mus. Nat. Hist.* 65: 1–756.

Cheung, C. & DeVantier, L. 2006. *Socotra: a natural history of the islands and their people*. Odyssey Books, Hong Kong.

Clement, P., Harris, A. & Davis, J. 1993. *Finches and sparrows: an identification guide*. Christopher Helm, London.

Collar, N. J. 2006. A partial revision of the Asian babblers (Timaliidae). *Forktail* 22: 85–112.

Collar, N. J., Fishpool, L. D. C., Pilgrim, J. D., Seddon, N. & Spottiswoode, C. N. (in prep.) The assessment of avian species rank, 2: quantification of character significance.

Cramp, S. & Perrins, C. M. (eds.) 1994. *The birds of the Western Palearctic*, vol. 8. Oxford Univ. Press.

Dickinson, E. C. (ed.) 2003. *The Howard & Moore complete checklist of the birds of the world*. Third edn. Christopher Helm, London.

Dowsett, R. J. & Dowsett-Lemaire, F. 1993. *A contribution to the distribution and taxonomy of Afrotropical and Malagasy birds*. Tauraco Res. Rep. 5. Tauraco Press, Liège.

Dymond, J. N. 1996. Biometric data of birds in southern Yemen and Socotra, spring 1993. *Sandgrouse* 17: 158–164.

Fournier, M., Patriat, P. & Leroy, S. 2001. Reappraisal of the Arabia-India-Somalia triple junction kinematics. *Earth & Planetary Sci. Letters* 189: 103–114.

Gill, F. & Wright, M. 2006. *Birds of the world: recommended English names*. Christopher Helm, London.

Grant, C. H. B. & Mackworth-Praed, C. W. 1944. Notes on eastern African birds. *Bull. Brit. Orn. Cl.* 64: 35–36.

Hall, B. P. & Moreau, R. E. 1970. *An atlas of speciation in African passerine birds*. Brit. Mus. (Nat. Hist.), London.

Hazevoet, C. J. 1995. *The birds of the Cape Verde Islands: an annotated check-list*. British Ornithologists' Union Check-list 13. British Ornithologists' Union, Tring.

Helbig, A. J., Knox, A. G., Parkin, D. T., Sangster, G. & Collinson, M. 2002. Guidelines for assigning species rank. *Ibis* 114: 518–525.

Kirwan, G. M. 1997. Socotra: Forbes-Watson manuscript. *Phoenix* 14: 6–7.

Kirwan, G. M. 2004. Some remarks on the taxonomy of Nubian Nightjar *Caprimulgus nubicus*, with particular reference to *C. n. jonesi* Ogilvie-Grant & Forbes, 1899. *Bull. Afr. Bird Cl.* 11: 117–125.

Kirwan, G. M. 2007. Studies of Socotran birds IV. Synonymization of six endemic bird taxa, with comments on the name *Onychognathus blythii creaghi*. *Sandgrouse* 29: 135–148.

Kirwan, G. M. & Grieve, A. 2007. Studies of Socotran birds II. One, two or three species: towards a rational taxonomy for the Golden-winged Grosbeak *Rhynchostruthus socotranus*. *Bull. Afr. Bird Cl.* 14: 159–169.

Kirwan, G. M., Martins, R. P., Morton, K. M. & Showler, D. A. 1996. The status of birds in Socotra and 'Abd Al-Kuri and the records of the OSME survey in spring 1993. *Sandgrouse* 17: 83–101.

Klaus, R. & Turner, J. R. 2004. The marine isotopes of the Socotra Archipelago. *Fauna of Arabia* 20: 45–115.

Laughton, A. S., Whitmarsh, R. B. & Jones, M. T. 1970. The evolution of the Gulf of Aden. *Phil. Trans. Roy. Soc. Lond. Ser. A* 267: 227–266.
Leonard, P. & Demey, R. 2006. Review: *The Birds of Africa*, vol. VII. *Bull. Afr. Bird Cl.* 13: 231–233.
Lynes, H. 1926. On the birds of north and central Darfur. Taxonomic appendix part 1. *Ibis* 12(2): 346–405.
Macdonald, J. D. 1957. *Contributions to the ornithology of western South Africa*. Brit. Mus., London.
Martins, R. P. 1996. Taxonomic treatment of endemic taxa in Socotra. *Sandgrouse* 17: 81–82.
Miller, A. G. & Morris, M. 2004. *Ethnoflora of the Soqotra Archipelago*. The Royal Botanic Garden, Edinburgh.
Moreau, R. E. & Greenway, J. C. 1962. Family Ploceidae, weaverbirds. Pp. 3–75 *in* Mayr, E. & Greenway, J. C. (eds.) *Check-list of birds of the world*, vol. 15. Mus. Comp. Zool., Cambridge, MA.
Neubert, E. 2002. The continental malacofauna of Arabia and adjacent areas. 1. Terrestrial molluscs of Samha and Darsa Islands (Al-Ikhwan), Socotra Archipelago, Yemen. *Fauna of Arabia* 19: 245–259.
Ogilvie-Grant, W. R. & Forbes, H. O. 1899. Descriptions of the new species of birds. *Bull. Liverpool Mus.* 2: 2–4.
Ogilvie-Grant, W. R. & Forbes, H. O. 1903. Birds of Sokotra and Abd-el-Kuri. Pp. 21–63 *in* Forbes, H. O. (ed.) *The natural history of Sokotra and Abd-el-Kuri*. R. H. Porter, London.
Payne, R. B. & Sorenson, M. D. 2003. Museum collections as sources of genetic data. Pp. 97–104 *in* Rheinwald, G. (ed.) Bird collections in Europe: the challenge of mutual cooperation. *Bonn. Zool. Beitr.* 51.
de Queiroz, K. 2005. Colloquium: Ernst Mayr and the modern concept of species. *Proc. Natl. Acad. Sci. USA* 102 suppl. 1: 6600–6607.
Rösler, H. & Wranik, W. 2004. A key and annotated checklist of the reptiles of the Socotra Archipelago. *Fauna of Arabia* 20: 505–534.
Sclater, P. L. & Hartlaub, G. 1881. On the birds collected in Socotra by Prof. I. B. Balfour. *Proc. Zool. Soc. Lond.* 1881: 165–175.
Sibley, C. G. & Monroe, B. L. 1990 *Distribution and taxonomy of the birds of the world*. Yale Univ. Press, New Haven, CT & London, UK.
Sluys, R. & Hazevoet, C. J. 1999. Pluralism in species concepts: dividing nature at its diverse joints. *Species Diversity* 4: 243–256.
Someren, V. G. L. van. 1922. Notes on the birds of east Africa. *Novit. Zool.* 29: 1–246.
Summers-Smith, D. 1984. The Rufous Sparrows of the Cape Verde Islands. *Bull. Brit. Orn. Cl.* 104: 138–143.
Summers-Smith, D. 1988. *The sparrows: a study of the genus Passer*. T. & A. D. Poyser, Calton.
Urban, E. K. 2004. Genus *Passer*. Pp. 1–41 *in* Fry, C. H. & Keith, S. (eds.) *The birds of Africa*, vol. 7. Christopher Helm, London.
White, C. M. N. 1963. *A revised check list of African flycatchers, tits, tree creepers, sunbirds, white-eyes, honey eaters, buntings, finches, weavers and waxbills*. Govt. Printer, Lusaka.
Warren, B. H., Bermingham, E., Bowie, R. C. K., Prys-Jones, R. P. & Thébaud, C. 2003. Molecular phylogeography reveals island colonization history and diversification of western Indian Ocean sunbirds (*Nectarinia*: Nectariniidae). *Mol. Phyl. & Evol.* 29: 67–85.
Wolters, H. E. 1982 *Die Vogelarten der Erde*. Paul Parey, Hamburg & Berlin.

Address: 74 Waddington Street, Norwich NR2 4JS, UK, e-mail: GMKirwan@aol.com